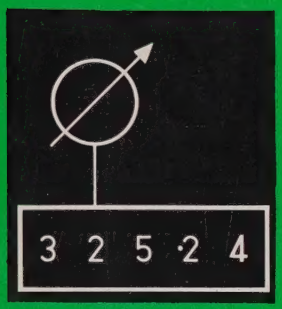
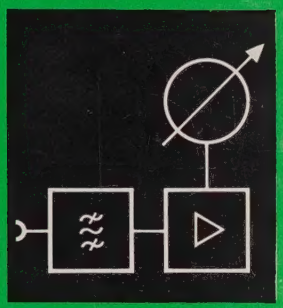
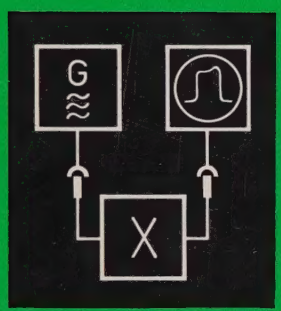




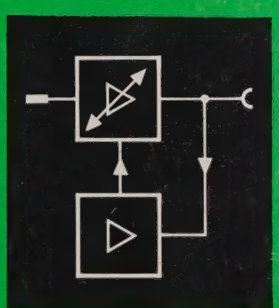


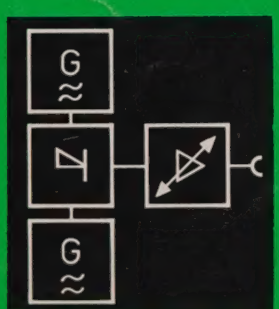
Level Generator

PS-6

Frequency range: coaxial 6 kHz to 18.6 MHz
balanced 6 kHz to 620 kHz

Description and
Operating Manual
340 and 340/1





MP MASTER
MA30391

WANDEL u. GOLTERMANN
REUTLINGEN / WÜRTT.

LEVEL GENERATOR PS-6

Frequency range: coaxial 6 kHz to 18.6 MHz
balanced 6 kHz to 620 kHz

Description and Operating Manual 340 and 340/1 B...

1. 1.69 Bi
0.15. 1.70 1837 UN v. 1800

Subject to change without notice

Wandel u. Goltermann · 7410 Reutlingen

dB/dBm
MHz
0,369 0 MHz
PS-6
Wandel u.Goltermann Reutlingen-Germany

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INTRODUCTION

The Level Generator PS-6 is a fully transistorized instrument which can be operated from internal batteries or from the AC power line. The generator has coaxial outputs for the frequency range of 6 kHz to 18.6 MHz and a balanced output for the range 6 to 620 kHz.

The high accuracy of the output level throughout the whole frequency range is achieved using a control network comprising a special rectifier circuit.

The generator output level is adjustable in steps of 2 dB (or 0.2 Np). In addition to this, a continuous variation of the output level in the range of 0 to either 2 dB or 20 dB (0.2 or 2 Np) - according to the meter range - is possible using a 10 turn helical potentiometer. The indication of the continuously variable level is made on the front panel-meter which has a switchable scale range of 2 or 20 dB (0.2 or 2 Np). Both voltage level and power level measurements are possible, whereby the output impedance is switchable to all commonly encountered values. The power level indication is always referred to the selected output impedance.

The low harmonic distortion factor of the output voltage should also be noted. The selected frequency is indicated in digital form by means of a 5 digit mechanical counter. A high accuracy of frequency selection is obtained in this manner. The 1 MHz steps of the coarse frequency tuning are phase-locked to a quartz crystal; the fine frequency tuning can be checked by comparison to an accurate 10 kHz crystal spectrum. The level generator may, in addition to this, be equipped with 3 optional crystal-controlled fixed frequencies. This allows the most commonly encountered frequencies (e.g. pilot frequencies of a CF system) to be easily selected.

The output voltage may be amplitude modulated in the frequency range of 0 to 100 kHz by feeding an external signal to the modulator input.

It is possible for the level Generator PS-6 to be complemented with the Level Meter SPM-6 (BN 341) to form a complete level measuring set. If generator and receiver are co-located, the frequency of both instruments can be varied synchronously from the receiver by means of an auxiliary connection. This simplifies operation considerably.

The instrument is provided with a universal coaxial socket which may be easily modified to accept all common plugs.

The level generator is available with dB/dBm calibration under the order number BN 340 and with Np/Npm calibration under BN 340/1.

1. SPECIFICATIONS

All essential characteristics of our instruments are indicated by guaranteed tolerance and limit specifications and not as typical values. They are valid for each instrument not only on delivery but also for the whole guarantee period.

If not especially annotated, the following values are valid for the permissible AC line voltage range or for the permissible battery charge, and for the given nominal operational temperature range directly after switching on.

1.1. BN 340 (dB/dBm calibration)

1.1.1. Frequency

Frequency range, coaxial . . . . . 6 kHz to 18.6 MHz [1]
balanced . . . . . 6 kHz to 620 kHz

Frequency adjustment, coarse . . . . . 1 MHz steps
fine . . continuous interpolation between the 1 MHz steps
fixed . . . . . max. of 3 fixed frequencies

During synchronous tuning, the frequency selection is made from the Level Meter SPM-6

Frequency indication . . . . . by mechanical counter
Scale division spacing on the last digit wheel . . . . . 200 Hz

Max. frequency error at + 20 °C
for multiples of 10 kHz after calibration and fixed frequencies . . . . . $\leqq \pm 3 \times 10^{-6} \pm 30$ Hz

for any frequency after calibration at the nearest 10 kHz marker . . . . . $\leqq \pm 500$ Hz

Mean temperature coefficient of the frequency within limit range of operation of the ambient temperature (see 1.1.7.) as referred to + 20 °C
for multiples of 10 kHz . . . . . $\leqq \pm 3 \times 10^{-7}$ / °C [2]

for fixed frequencies . . . . . $\leqq \pm 3 \times 10^{-7}$ /°C ± 3 Hz / °C

for any frequency without re-calibration at the nearest 10 kHz marker . . . . . $\leqq \pm 100$ Hz/°C

1.1.2. Generator output level

switchable to voltage level (0 dB $\hat{=}$ 0,775 V) or to power level (0 dBm $\hat{=}$ 1 mW into Z) for all impedances

Generator level for 0 dB meter reading . . . . . -78; -76; ...; 0 dB
-72; -70; ...; +6 dBm

Meter scale
upper . . . . . -2.2 dB to + 0.3 dB
lower . . . . . -22 dB to + 3 dB

---

1) Series A : 17 MHz

2) Value valid for the 10 kHz spectrum used for comparison

Accuracy of the generator level at output I

Accuracy of the generator level in 0 dB (+ 6 dBm) range, 0 dB reading and + 20 °C

Coaxial output

$Z_{out} = Z_L = 50\ \Omega$ to 75 Ω and		
$Z_{out} = 0$, $Z_L = 75\ \Omega$	f = 20 kHz to 6 MHz . .	better than ± 0.15 dB
$Z_{out} = Z_L = 50\ \Omega$ to 75 Ω	f = 6 kHz to 18.6 MHz [1] .	better than ± 0.20 dB
$Z_{out} = Z_L = 124\ \Omega$ to 150 Ω	f = 6 kHz to 1.5 MHz . .	better than ± 0.15 dB

Balanced output, f = 6 to 620 kHz

$Z_{out} = Z_L = 124\ \Omega$ to 150 Ω	better than ± 0.15 dB
$Z_{out} = 0$, $Z_L = 150\ \Omega$	better than ± 0.20 dB

Accuracy of the generator level selector referred to 0 dB (+ 6 dBm) position, scale expanded [2]

Coaxial output

$Z_{out} = Z_L = 75\ \Omega$ and		
$Z_{out} = 0$, $Z_L = 75\ \Omega$	f = 20 kHz to 6 MHz . .	better than ± 0.10 dB
$Z_{out} = Z_L = 50\ \Omega$ to 65 Ω	f = 20 kHz to 6 MHz . .	better than ± 0.15 dB
$Z_{out} = Z_L = 50\ \Omega$ to 75 Ω	f = 6 kHz to 18.6 MHz [1] .	better than ± 0.20 dB
$Z_{out} = Z_L = 124\ \Omega$ to 150 Ω	f = 6 kHz to 1.5 MHz . .	better than ± 0.10 dB

Balanced output

$Z_{out} = Z_L = 124$ to 150 Ω	better than ± 0.10 dB
$Z_{out} = 0$, $Z_L = 150\ \Omega$	better than ± 0.10 dB

Accuracy of the 20 dB meter scale, ref. to 0 dB marker . better than ± 1 % of FSD

Accuracy of the 2 dB meter scale, ref. to 0 dB marker . . better than ± 0.03 dB

Mean temperature coefficient within the limit range of operation, ref. to + 20 °C . . . . . ≦ ± 0.01 dB/ °C

1.1.3. Output Impedance, switchable

coaxial	0, 50, 60, 65, 75, 124, 135, 150 Ω
balanced	0, 124, 135, 150 Ω

Reflection coefficient

coaxial output: $Z_{out} = 50\ \Omega$	≦ 0.05
$Z_{out} = 60, 65\ \Omega$	≦ 0.03
$Z_{out} = 75\ \Omega$	≦ 0.02
$Z_{out} = 124$ to 150 Ω, f = 6 kHz to 620 kHz	≦ 0.01
balanced output: f = 6 kHz to 620 kHz	≦ 0.03
Output balance at f = 620 kHz	≧ 40 dB [3]

---

1) Series A : 17 MHz

2) With scale expansion off, the given values are valid from -2 dB to +1 dB. At lower meter reading these values are only valid for the 1 dB steps from -10 dB to -70 dB (-4 to -64 dBm).

3) The balance of the output voltage is measured by connecting a low-dispersion balancing choke with centre tap between output clamps a - b of the generator. The clamps should also be terminated with Z = 150 Ω. Switch the generator to $Z_{out} = Z = 150\ \Omega$. The level between the centre tap and ground is now selectively measured with the aid of a level meter. During this, the centre tap of the choke is loaded with $\frac{Z}{4} = 37.5\ \Omega$ to ground. The output balance is calculated as the difference between the generator level which has been reduced by 6 dB, and the level indicated on the level meter.

1.1.4. Harmonic and non-harmonic interference voltage at a generator output level of 0 dB (+ 6 dBm) and $Z_{out} = Z_L$ or $Z_{out} = 0$, $Z_L = 75\ \Omega$

Attenuation of harmonic distortion, 2nd and 3rd harmonics

with fundamental wave f = 20 kHz to 6 MHz	≧ 50 dB
f = 6 kHz to 18.6 MHz [1]	≧ 40 dB

Signal to non-harmonic interference voltage ratio ≧ 60 dB

1.1.5. Output II, $Z_{out} = Z_L = 75\ \Omega$

Output level at a 0 dB or 0 dBm meter reading (see 2.5.) . max. -10 dB (245 mV)
min. -23 dB (60 mV)

1.1.6. Inputs

Remote control input, 1 MHz standard frequency Bu 1901

Input impedance	75 Ω
Required input voltage	U_{rms} = 200 mV

Synchronous tuning input, 24 to 42.6 MHz [2] carrier signal Bu 801

Input impedance	75 Ω
Required input voltage	U_{rms} = 40 mV

Modulation input [3]

Frequency range	0 to 100 kHz
Input impedance	600 Ω
Required modulating voltage for sinusoidal modulation	$U_{pp} \approx 6$ mV per degree mod.
Maximum permissible input voltage	U_{rms} = 10 V

1.1.7. Permissible Ambient Temperature Ranges

Limit range of storage	-40 °C to +60 °C
Limit range of operation	-10 °C to +50 °C
Nominal range of use	+10 °C to +35 °C

1.1.8. Power Supply

AC line operation	110 V to 127 V; 220 V to 240 V + 10 % - 15 %
AC line frequency	45 to 65 Hz
Power consumption	approx. 17 VA

Battery operation with 6 internal Nickel-Cadmium accumulators 5/500 DKZ

Operational period without recharging	approx. 5 hours
Duration of charge	approx. 14 hours

---

1) Series A : 17 MHz

2) Series A : 41 MHz

3) When the modulation input is used, the generator level indication is inoperative. The output level can only be varied in steps of 10 dB.

1.1.9. Dimensions and Weight

Dimensions in inches and mm suitable for 19" rack mounting

Width (excluding handles)	17.5" (443 mm)
Overall height	6.9" (176 mm)
Depth (including handles)	16.0" (407 mm)
Weight including batteries	49.6 lb (18 kg)

Subject to change without notice

1.2. BN 340/1 (Np/Npm calibration)

If not especially annotated, the values are valid for the permissible AC line voltage range or for the permissible battery charge, and for the given nominal operational temperature range directly after switching on.

1.2.1. Frequency

Frequency range, coaxial . . . . . 6 kHz to 18.6 MHz [1]
balanced . . . . . 6 kHz to 620 kHz

Frequency adjustment, coarse . . . . . 1 MHz steps
fine . . . continuous interpolation of the 1 MHz steps
fixed . . . . . max. of 3 fixed frequencies

During synchronous tuning, the frequency selection is made from the Level Meter SPM-6

Frequency indication . . . . . by mechanical counter
Scale division spacing of the last digit wheel . . . . . 200 Hz

Max. frequency error at +20 °C
for multiples of 10 kHz after calibration and fixed frequencies . . . . . $\leqq \pm 3 \times 10^{-6} \pm 30$ Hz

for any frequency after calibration at the nearest 10 kHz marker . . . . . $\leqq \pm 500$ Hz

Mean temperature coefficient within the operational ambient temperature limits (see 1.7.) as referred to +20 °C
for multiples of 10 kHz . . . . . $\leqq \pm 3 \times 10^{-7}$ /°C [2]

for fixed frequencies . . . . . $\leqq 3 \times 10^{-7}$ /°C ± 3 Hz/°C

for any frequency without re-calibration at the nearest 10 kHz marker . . . . . $\leqq \pm 100$ Hz/°C

1.2.2. Generator level, switchable to voltage level (0 Np $\hat{=}$ 0.775 V) or power level for all impedance values (0 Np $\hat{=}$ 1 mW)

Generator level at a 0 Np meter reading . . . . . -7.8 to 0 Np
-7.2 to 0 Npm in 0.2 Np steps

Meter scale expansion
upper . . . . . -2.0 to +0.1 Np
lower . . . . . -0.25 to +0.03 Np

---

1) Series A : 17 MHz

2) Value valid for the 10 kHz spectrum used for comparison

Accuracy of the generator level at output I

Accuracy of the generator level in 0 Np (+ 0.6 Npm) range, 0 Np reading and + 20 °C

coaxial output

$Z_{out} = Z_L = 50\ \Omega$ to 75 Ω and		
$Z_{out} = 0$, $Z_L = 75\ \Omega$	f = 20 kHz to 6 MHz . .	better than ± 0.015 Np
$Z_{out} = Z_L = 50\ \Omega$ to 75 Ω	f = 6 kHz to 18.6 MHz [1] .	better than ± 0.02 Np
$Z_{out} = Z_L = 124\ \Omega$ to 150 Ω	f = 6 kHz to 1.5 MHz. .	better than ± 0.015 Np

Balanced output f = 6 to 620 kHz

$Z_{out} = Z_L = 124\ \Omega$ to 150 Ω	better than ± 0.015 Np
$Z_{out} = 0$, $Z_L = 150\ \Omega$	better than ± 0.02 Np

Accuracy of the generator level selector referred to 0 Np (+ 0.6 Npm) position, scale expanded [2]

Coaxial output

$Z_{out} = Z_L = 75\ \Omega$ and		
$Z_{out} = 0$, $Z_L = 75\ \Omega$	f = 20 kHz to 6 MHz . .	better than ± 0.01 Np
$Z_{out} = Z_L = 50\ \Omega$ to 65 Ω	f = 20 kHz to 6 MHz . .	better than ± 0.015 Np
$Z_{out} = Z_L = 50\ \Omega$ to 75 Ω	f = 6 kHz to 18.6 MHz [1] .	better than ± 0.02 Np
$Z_{out} = Z_L = 124\ \Omega$ to 150 Ω	f = 6 kHz to 1.5 MHz. .	better than ± 0.01 Np

Balanced output, f = 6 to 620 kHz

$Z_{out} = Z_L = 124$ to 150 Ω	better than ± 0.01 Np
$Z_{out} = 0$, $Z_L = 150\ \Omega$	better than ± 0.01 Np

Accuracy of the 2 Np meter scale, ref. to 0 Np marker . better than ± 1 % of FSD

Accuracy of the 0.25 Np meter scale, ref. to 0 Np . . better than ± 0.003 Np

Mean temperature coefficient within the limit range of operation, ref. to + 20 °C . . . . . $\leqq \pm 0.001$ Np/°C

1.2.3. Output Impedance, switchable

coaxial	0, 50, 60, 65, 75, 124, 135, 150 Ω
balanced	0, 124, 135, 150 Ω

Reflection coefficient

coaxial output: $Z_{out} = 50\ \Omega$	$\leqq 0.05$
$Z_{out} = 60, 65\ \Omega$	$\leqq 0.03$
$Z_{out} = 75\ \Omega$	$\leqq 0.02$
$Z_{out} = 124$ to 150 Ω, f = 6 kHz to 1.5 MHz . . .	$\leqq 0.01$
balanced output: f = 6 kHz to 620 kHz	$\leqq 0.03$
Output balance at f = 620 kHz	$\geqq 4.6$ Np [3]

---

1) Series A : 17 MHz

2) With scale expansion off, the given values are valid from -0.2 to +0.1 Np. At lower meter reading these values are only valid for the 1 Np steps from -1 to -7 Np (-0.4 to -6.4 Npm)

3) The balance of the output voltage is measured by connecting a low-dispersion balancing choke with centre tap between output clamps a - b of the generator. The clamps should also be terminated with Z = 150 Ω. Switch the generator to $Z_{out} = Z = 150\ \Omega$. The level between the centre tap and ground is now selectively measured with the aid of a level meter. During this, the centre tap of the choke is loaded with $\frac{Z}{4} = 37.5\ \Omega$ to ground. The output balance is calculated as the difference between the generator level which has been reduced by 0.7 Np, and the level indicated on the level meter.

1.2.4. Harmonic and non-harmonic interference
at a generator output level of 0 Np (+0.6 Npm)
and $Z_{out} = Z_L$ or $Z_{out} = 0$, $Z_L = 75\ \Omega$

Attenuation of harmonic distortion, 2 nd and 3rd harmonics

with fundamental wave f = 20 kHz to 6 MHz . . . . . ≧ 5.7 Np
f = 6 kHz to 18.6 MHz [1] . . . . . ≧ 4.6 Np

Signal to non-harmonic interference voltage ratio . . . . . ≧ 7 Np

1.2.5. Output II, $Z_{out} = Z_L = 75\ \Omega$

Output level at a 0 Np or 0 Npm meter reading (see 2.5.) . max. -1 Np (285 mV)
min. -2.3 Np (78 mV)

1.2.6. Inputs

Remote control input, 1 MHz standard frequency Bu 1901

Input impedance . . . . . 75 Ω
Required input voltage . . . . . U_{rms} = 200 mV

Synchronous tuning input, 24 to 42.6 MHz [2] carrier signal Bu 801

Input impedance . . . . . 75 Ω
Required input voltage . . . . . U_{rms} = 40 mV

Modulation input [3]

Frequency range . . . . . 0 to 100 kHz
Input impedance . . . . . 600 Ω
Required modulating voltage for sinusoidal modulation $U_{pp} \approx 6$ mV per degree mod.
Maximum permissible input voltage . . . . . U_{rms} = 10 V

1.2.7. Permissible Ambient Temperature Ranges

Limit range of storage . . . . . -40 °C to +60 °C
Limit range of operation . . . . . -10 °C to +50 °C
Nominal range of use . . . . . +10 °C to +35 °C

1.2.8. Power Supply

AC line operation . . . . . 110 V to 127 V; 220 V to 240 V + 10 % - 15 %

AC line frequency . . . . . 45 to 65 Hz

Power consumption . . . . . approx. 17 VA

---

1) Series A : 17 MHz

2) Series A : 41 MHz

3) When the modulation input is used, the generator level indication is inoperative. The output level can only be varied in steps of 1 Np.

Battery operation with 6 internal Nickel-Cadmium accumulators 5/500 DKZ

Operational period without recharging	approx. 5 hours
Duration of charge	approx. 14 hours

1.2.9. Dimensions and Weight

Dimensions in inches and mm, according to 19" standard

Width (Excluding handles)	17.5" (443 mm)
Overall height	6.9" (176 mm)
Depth (including handles)	16.0" (407 mm)
Weight including batteries	39.6 lb (18 kg)

Subject to change without notice

2. OPERATION

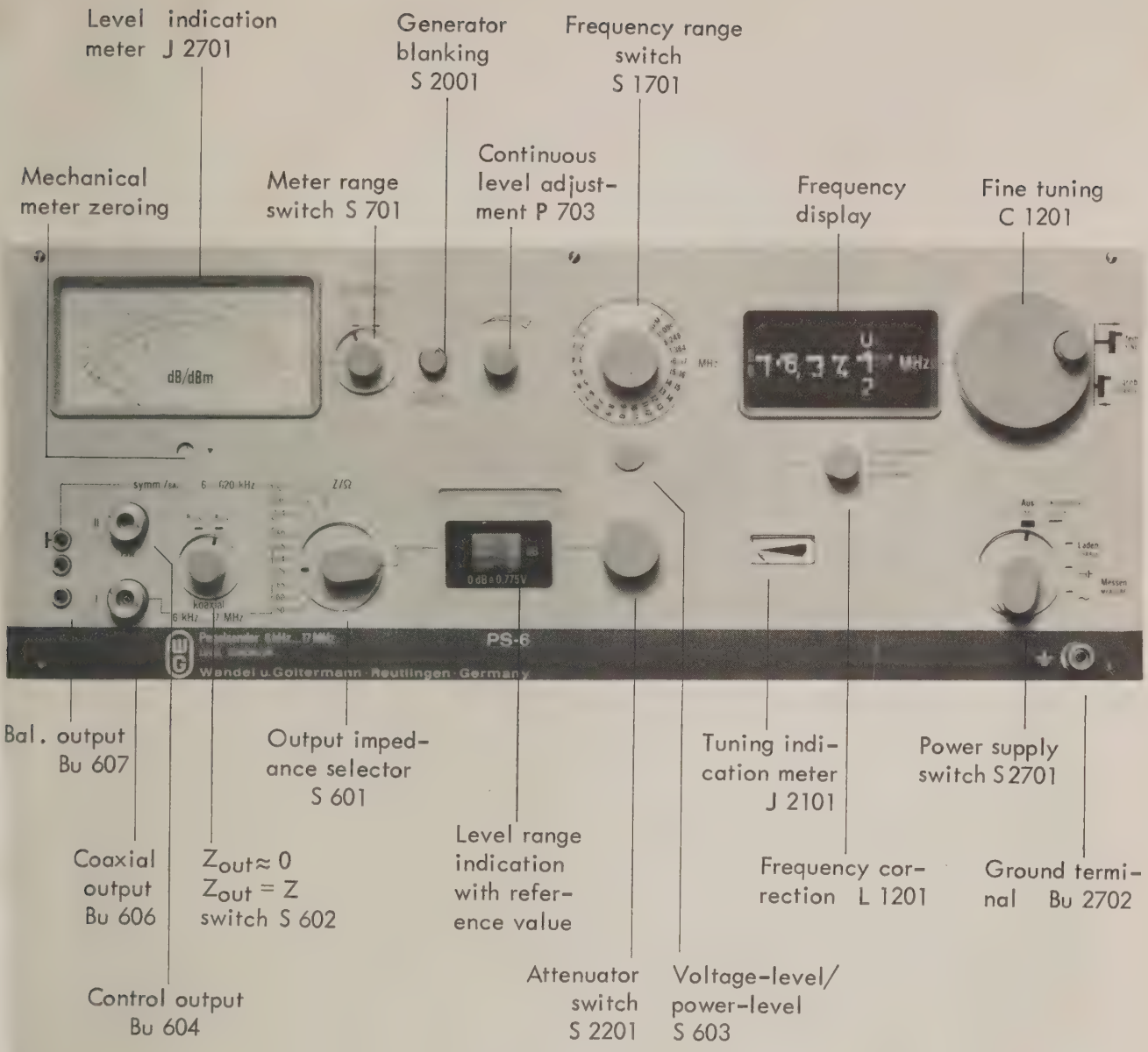

Level indication meter J 2701
Generator blanking S 2001
Frequency range switch S 1701
Mechanical meter zeroing
Meter range switch S 701
Continuous level adjustment P 703
Frequency display
Fine tuning C 1201
dB/dBm
PS-6
Wandel u. Goltermann · Reutlingen · Germany
Bal. output Bu 607
Coaxial output Bu 606
Control output Bu 604
Output impedance selector S 601
Level range indication with reference value
Attenuator switch S 2201
Voltage-level/ power-level S 603
Tuning indication meter J 2101
Frequency correction L 1201
Power supply switch S 2701
Ground terminal Bu 2702

Fig. 2-1

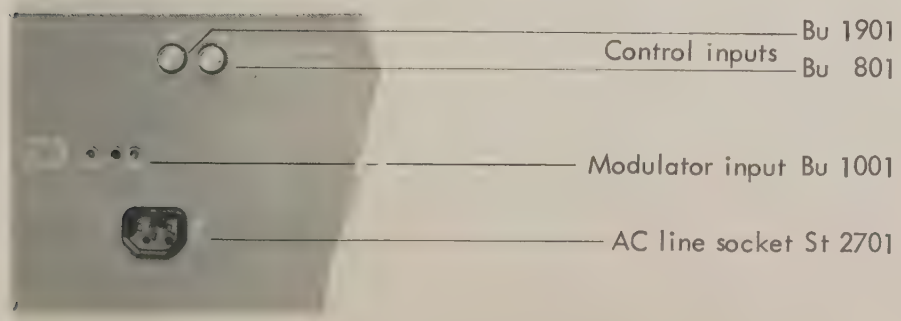

Control inputs
Bu 1901
Bu 801
Modulator input Bu 1001
AC line socket St 2701

Fig. 2-2

2. OPERATION

2.1. Setting-up of the Instrument

The Level Generator PS-6 has been designed for mobile operation and for a temperature range of - 10°C to +50° C (14°F to 122°F).

The front panel controls are accessable after removing the protective cover.

The instrument can be operated in a vertical or horizontal position. The operation is simplified, in some cases, if the feet at the base of the instrument are folded out so that the instrument is given a slight tilt. See Fig. 2-3

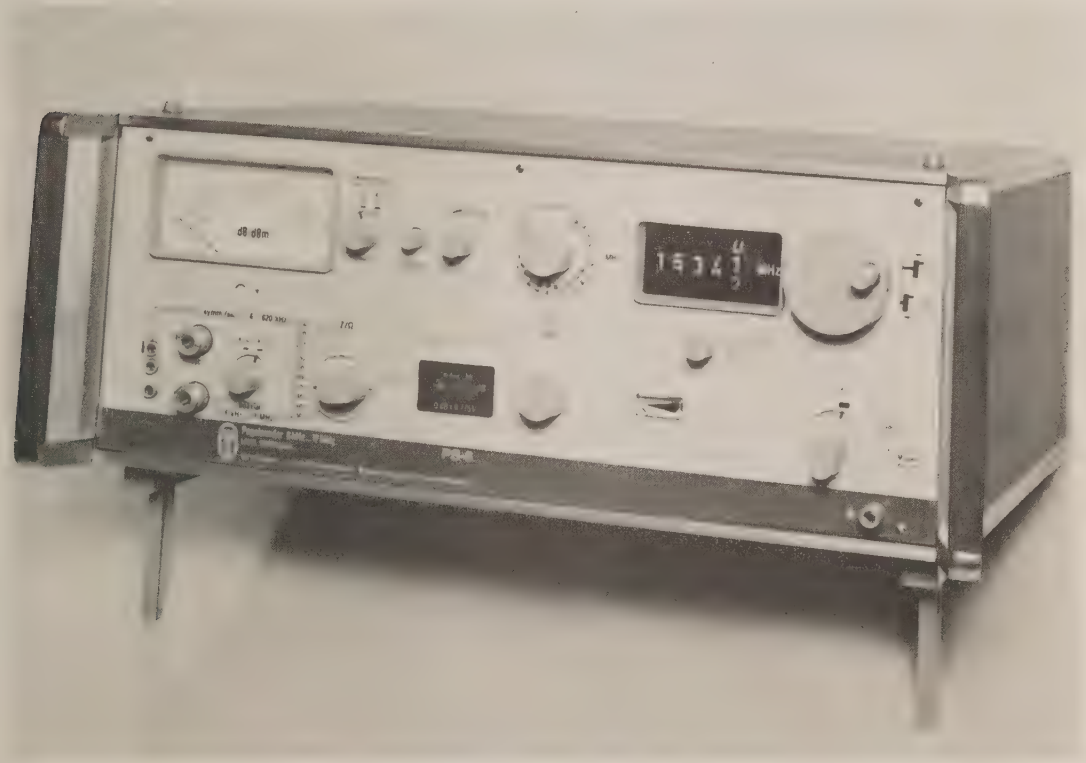


Fig. 2-3

Transport Instructions

If the PS-6 is to be transported or is mounted in a vehicle, the power supply switch S 2701 (see illustration on opposite page) should be placed to its "off" position to avoid damaging the meter during transport.

2.1.1. CONTROLS

The control elements, display devices and the output sockets for the generator signal are arranged clearly on the front panel of the level generator. The synchronous tuning inputs, the modulation input, and the AC line connection are located on the rear panel of the instrument. The location of all controls, connectors, meters etc. on the front and rear panel, can be seen from the illustrations Fig. 2-1 and 2-2.

2.2. Connection and Preparations for Operation

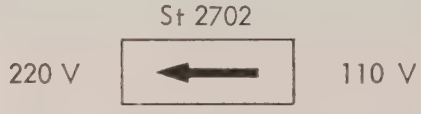
Caution: The ground connection Bu 2702 is not connected to the protective ground connection. When necessary, the instrument can be connected via this terminal to any required ground potential.

2.2.1. Mechanical Zero

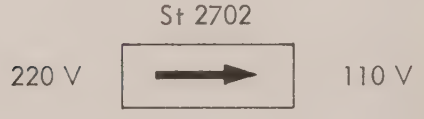
Before switching on the instrument, the mechanical meter zero "▼" of the level indicator J 2701 should be checked and, if necessary, reset.

2.2.2. Power Line Operation

The instrument is set in the factory for AC voltages in the range of 198 to 264 V and can thus be operated from AC sources of 220 or 240 V. If it is necessary to operate from AC sources of 110, 115 or 127 V, this can be made by the customer by tilting the hinged chassis upwards and re-plugging the AC voltage selector St 2702 which is then accessable (see internal view shown in the appendix).



range selected 198 to 264 V



range selected 99 to 140 V

The AC fuse (0.8 A slow blow) need not be exchanged when the AC voltage range is altered.

After the level generator has been set to the correct AC voltage, the instrument should be connected to the AC power line via the power cable supplied. The AC power socket is to be found at the rear of the PS-6.

If the mode switch S 2701 set to the position "Measure ~ ", the instrument is operational at once with ful accuracy.

2.2.3. Battery Operation

When delivered, the level generator is equipped with all necessary batteries. New nickel cadium batteries can be installed after the right hand sidepanel has been removed (see Fig. 5-2).

2.2.3.1. Battery check

Before making measurements during battery operation the battery change should be checked by placing the mode switch S 2701 to " Bat. check" . The indicator J 2701 now indicates the battery voltage. As long as the needle is withing the blue range of the meter scale, the battery is sufficiently charged. It should be noted, however, that the voltage drops slightly during the first 10 minutes of battery operation. If the needle indication does not reach the marked range, the battery should be recharged. This is also recommended if the pointer is in lower portion of the blue range. If the battery voltage is too low, a device protecting the instrument against excess discharge will actuate. This will cause the instrument to be automatically switched on and off.

2.2.3.2. Charging the battery

The mode switch S 2701 should be brought to the position "Charge" and the level generator connected to the AC power line via AC connection socket St 2701. The charging period for a completely discharged battery is approximately 14 hours. This period may be exceeded by 10 hours. Continuous overcharging in excess of 10 hours, however, will damage the battery. It should be noted that batteries may only be charged in the ambient temperature range of 0 to + 45 °C.

2.2.3.3. Battery operation

If the battery has been charged and the mode switch S 2701 is in the position "Measure ⊣⊢", the instrument is immediately operational, as is also the case during AC operation. If the battery has been fully charged, approximately 5 hours of operation are possible. The automatic excess discharge protection will disconnect the instrument the moment that the battery voltage drops below the lowest permissable value. In this way, errors in measurement and damage to the battery, which could result from deep discharge, are avoided.

Caution: Since the battery voltage will increase after switching off the instrument, the automatic excess discharge protection circuit will switch on the PS-6 again after a short period of time. The switching process will be thus repeated.

2.2.3.4. Trickle charge

If the AC power line is connected and the mode switch set to "Measure ⊣⊢", the power will be taken from the AC line. Simultaneously the battery will be charged with a small current (trickle charge). This means that continuous AC operation of the instrument should be made in the "Measure " mode.

2.3. Generation of the Output Signal

The test object is connected to the level generator by means of a suitable interconnection cable. It is possible to use all outputs simultaneously if this should be favourable for the measuring task in question. However, the output voltage is not simultaneously available at the balanced output and the coaxial output I. The control output II may be loaded independent of the selected generator output.

2.3.1. Generator Outputs, Output Impedance

Output socket Bu 606 is provided for measurements on coaxial test objects in the frequency range of 6 kHz to 18.6 MHz [1]; socket Bu 607 is used with balanced test objects in the range 6 kHz to 620 kHz. The change-over switching be-

[1] Series A : 17 MHz

tween the coaxial and balanced output is made with switch S 601, which simultaneously allows selection of the required output impedance. When making measurements on matched test objects, switch S 602 should be brought to position " Ri = Z".

If the voltage at the input of the test object is to be independent of its input impedance, switch S 602 should be placed in the "Ri≈0" position. The output socket and the corresponding reference resistor during power level measurement are also determined by the position of the output impedance selector S 601.

The coaxial control output II (Bu 604) can be used over the entire frequency range independent of the other two outputs. This output is used, for instance, for the connection of a frequency counter. The impedance of the control output is 75 Ω; this output cannot be switched to other impedance values. A level of between -10 and -23 dB (-1 to -2.3 Np) is available at output II (Bu 604). More accurate values are given in Tables 2-2 and 2-3.

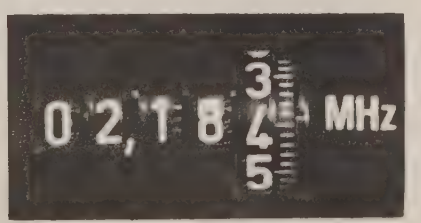
2.3.2. Selection of the Generator Frequency

2.3.2.1. Continuously variable frequency tuning

The desired receiving frequency is set coarsely in 1 MHz steps with the aid of the frequency range switch S 1701 and is, in addition, continuously fine tuned with C 1201. The frequency selection can be made coarse (tuning knob depressed) or fine (tuning knob drawn forward). In order to obtain an overlap of the 1 MHz range, the tuning range of the fine frequency tuning is 1.1 MHz. The digital display will automatically correct for over-ranging at the upper limit of the fine tuning range. The last digits of the display have the value of n x 1 kHz. Additional sub-divisions with 200 Hz spacing allow frequency differences in the order of 100 Hz to be determined.

Example:

Selected frequency = 2.1839 MHz



2.3.2.2. Frequency calibration

In order to obtain a high accuracy of frequency tuning, the digital frequency display of the instrument can be checked in multiples of 10 kHz (0 as last digit) to a frequency spectrum with quartz crystal accuracy.
To calibrate the frequency, the digital display is set to an accurate multiple of 10 kHz by means of the frequency fine tuning C 1201. Then the frequency correction is varied by aligning L 1201 until the needle of the tuning indicator J 2101 reaches a minimum deflection at the left side of the scale.

The dip of the tuning indicator pointer will commerce several kHz in advance of the actual comparison point due to the reduction of the meter deflection.
The needle of the tuning indicator follows the vernier setting relatively slowly. However, if the pointer were to follow the indication rapidly on tuning the vernier and gave a very sharp minimum, the the alignment could be erroneously made to a multiple of 5 kHz.
After the frequency scale has been calibrated, the frequency error of the setting is better than 500 Hz for frequencies 5 kHz above and below the selected calibration point. For all other frequencies the possible error in the display is approximately 1 kHz. This means that for most measurements, just one single calibration of the fine tuning at any point of the scale is sufficient.

2.3.2.3. Fixed frequencies

The last three positions of the frequency range switch S 1701 were provided for the tuning of the level generator to crystal controlled fixed frequencies. If one of the three positions is selected, the instrument will be ready to receive at the frequency shown on switch S 1701. In this case, the fine frequency tuning is inoperative which is indicated by the covering of the digital frequency display.

2.3.2.4. Remote tuning of the level generator from the Selective Level Meter SPM-6 (BN 341)

If the level generator is used in conjunction with the Level Meter SPM-6, a level measuring system is formed which can be utilized with great advantage if generator and receiver are synchronously tuned. In this mode of operation, the level meter takes over the frequency control of the generator. For this purpose two cable connections are necessary:

a) Connection of the control output Bu 2401 (24 to 42.6 MHz)[1] of the SPM-6 to the control input Bu 801 of PS-6,

b) Connection of the control output Bu 2402 (1 MHz) of the SPM-6 to the control input Bu 1901 of the PS-6.

The frequency range switch of the PS-6 should be set to position " SPM-6". In this manner generator and receiver are tuned to the frequency indicated on the SPM-6. This is also the case if a fixed frequency is selected.

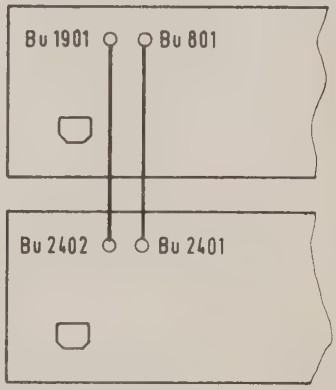


Fig. 2-4

2.3.3. Adjustment of the Generator Output Level

2.3.3.1. Selection of the output level in steps.

The generator level can be selected in steps of 2 dB (0.2Np) with the aid of an attenuator (S 2201). The level values indicated in the indicator window are valid for a meter reading of 0 dB (0 Np).

2.3.3.2. Continuous adjustment of the output level

The continuous adjustment of the output level is made with the aid of potentiometer P 703. In order to utilize the advantages of the small level steps, the

[1] Series A : 41 MHz

adjustment range of potentiometer P 701 and the scale range of the meter J 2701 can be varied with the aid of the meter range switch S 701.

It is normally more favourable to use the 2 dB (0.2 Np) meter range (switch S 701 in left-hand position). This is required especially for a more accurate adjustment of the generator output level.

If the level is to be continuously varied by more than 2 dB (0.2 Np), the unexpanded meter scale and the 20 dB (2 Np) adjustment range of potentiometer P 703 must be used (meter range switch in right-hand position This adjustment is also suitable for general measurements.

2.3.3.3. Generator blanking

During some measurements, it is necessary to temporarily switch off the generator output signal. This can be carried out by depressing pushbutton S 2001 located on the front panel of the instrument. The selected impedance will be maintained even though the output signal is no longer generated.

2.3.3.4. Voltage level/power level calibration

With the aid of the recessed switch S 603, the instrument can be switched from voltage level calibration

0 dB $\hat{=}$ 0.775 V

or 0 Np $\hat{=}$ 0.775 V

to power level calibration

0 dBm $\hat{=}$ 1 mW into Z

or 0 Npm $\hat{=}$ 1 mW into Z

Z is the input impedance selected (see also paragraph 2.3.1.). The type of calibration is indicated below the level range switch.

2.4. External Amplitude Modulation

The generator signal can be amplitude modulated by external voltages in the frequency range of 0 to 100 kHz.

The level meter J 2701 and the level control are inoperative if the AM input is in use. The level adjustment in 2 dB steps and continuously, is no longer possible; the level may only be switched in steps of 10 dB/dBm (1 Np/Npm). A signal deviating from the selected level is now available at the output. The following table lists the various output levels at a modulation depth of 0% (m = 0).

Attenuator position S 2202	Output-level at m = 0	Attenuator position S 2201	Output-level at m = 0
0 dB to -8 dB (+6 to -2 dBm)	approx. -5 dB	0 to -0.8 Np (+ 0.6 to -0.2 Npm)	approx. 0.5 Np
-10 dB to -18 dB (-4 to -12 dBm)	approx. -15 dB	-1 to -1.8 Np (- 0.4 to -1.2 Npm)	approx. 1.5 Np
-20 dB to -28 dB (-14 to -22 dBm)	approx. -25 dB	-2 to -2.8 Np (-1.4 to -2.2 Npm)	approx. 2.5 Np
-30 dB to -38 dB (-24 to -32 dBm)	approx. -35 dB	-3 to -3.8 Np (- 2.4 to -3.2 Npm)	approx. 3.5 Np
-40 dB to -48 dB (-34 to -42 dBm)	approx. -45 dB	-4 to -4.8 Np (- 3.4 to -4.2 Npm)	approx. 4.5 Np
-50 dB to -58 dB (-44 to -52 dBm)	approx. -55 dB	-5 to -5.8 Np (-4.4 to -5.2 Npm)	approx. 5.5 Np
-60 dB to -68 dB (-54 to -62 dBm)	approx. -65 dB	-6 to -6.8 Np (- 5.4 to -6.2 Npm)	approx. 6.5 Np
-70 dB to -78 dB (-64 to -72 dBm)	approx. -75 dB	-7 to -7.8 Np (- 6.4 to -7.2 Npm)	approx. 7.5 Np

Table 2-1 Output level with external AM.

The output level can be increased by 6 dB (0.7 Np) with respect to the values given in the table (positive modulation voltage) or decreased by at least 40 dB (4.6 Np) (negative modulation voltage). As can be seen in table 2-1, the instrument is designed so that the output signal is not distorted by the modulating voltage, independent of the attenuator position and degree of modulation.

A voltage of $U_{pp} \approx 6$ mV is required for each percent of modulation. Modulation levels of up to 100 % are possible.

The harmonic distortion factor for the 2nd and 3rd harmonics are, at a modulating frequency of 20 kHz:

m = 30 % approx. 3 %

m = 80 % approx. 6 %

The input impedance is 600 Ω for voltages up to $U_{pp} = 1$ V; it is decreased at higher modulating voltage levels due to the built-in protective diodes.

Furthermore, the AM input may be used for external level control purposes. It is thus possible, for instance, to control the generator level by means of the DC output of the Selective Level Meter SPM-6.

2.5. Level at Output II

The level at output II with a 0 dB (0 Np) reading on meter J 2701 is given in the following table:

VOLTAGE LEVEL

Level at Bu 606 or 607	Level at control output Bu 604
0 dB	-10 dB
-2 dB	-12 dB
-4 dB	-14 dB
-6 dB	-16 dB
-8 dB	-18 dB
-10 dB	-10 dB
-12 dB	-12 dB
-14 dB	-14 dB
-16 dB	-16 dB
-18 dB	-18 dB
-20 dB	-10 dB
etc.	

Level at Bu 606 or 607	Level at control output Bu 604
0 Np	-1 Np
-0.2 Np	-1.2 Np
-0.4 Np	-1.4 Np
-0.6 Np	-1.6 Np
-0.8 Np	-1.8 Np
-1 Np	-1 Np
-1.2 Np	-1.2 Np
-1.4 Np	-1.4 Np
-1.6 Np	-1.6 Np
-1.8 Np	-1.8 Np
-2 Np	-1 Np
etc.	

Table 2-2 Level at output II in voltage level mode.

For other meter readings, the indicated value must be added in the correct sign. If the power level mode has been selected, the given voltage level will be reduced, according to the adjusted impedance value, by the correction factor

$$10 \times \log_{10} \frac{Z}{150}$$

POWER LEVEL

Level at Bu 606 or 607	Level at control output Bu 604
+6 dBm	-10 dB - corr.
+4 dBm	-12 dB - corr.
+2 dBm	-14 dB - corr.
0 dBm	-16 dB - corr.
-2 dBm	-18 dB - corr.
-4 dBm	-10 dB - corr.
-6 dBm	-12 dB - corr.
-8 dBm	-14 dB - corr.
-10 dBm	-16 dB - corr.
-12 dBm	-18 dB - corr.
-14 dBm	-10 dB - corr.
etc.	

Level at Bu 606 or 607	Level at control output Bu 604
+0.6 Npm	-1 Np - corr.
+0.4 Npm	-1.2 Np - corr.
+0.2 Npm	-1.4 Np - corr.
0 Npm	-1.6 Np - corr.
-0.2 Npm	-1.8 Np - corr.
-0.4 Npm	-1 Np - corr.
-0.6 Npm	-1.2 Np - corr.
-0.8 Npm	-1.4 Np - corr.
-1.0 Npm	-1.6 Np - corr.
-1.2 Npm	-1.8 Np - corr.
-1.4 Npm	-1 Np - corr.
etc.	

Correction values (corr.)

Z =		
150 Ω	0 dB	0.09 Np
135 Ω	0.5 dB	0.14 Np
124 Ω	0.9 dB	0.18 Np
75 Ω	3.0 dB	0.44 Np
65 Ω	3.7 dB	0.51 Np
60 Ω	4.0 dB	0.55 Np
50 Ω	4.8 dB	0.64 Np

Table 2-3 Level at output II in power level mode.

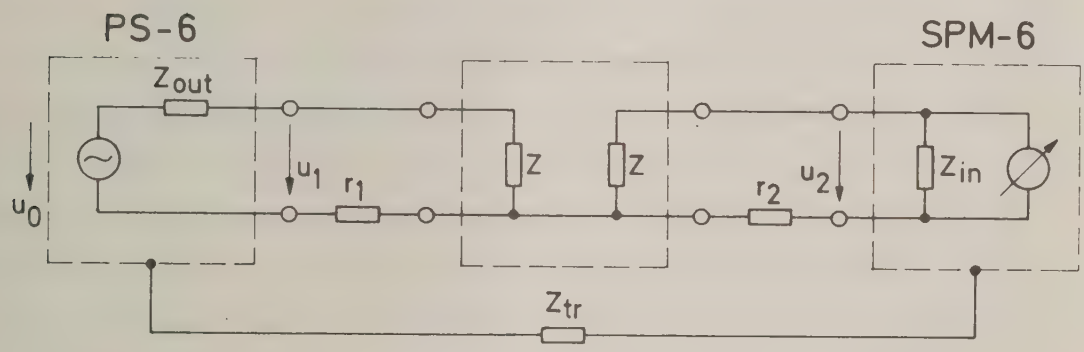
3. TECHNOLOGICAL INSTRUCTIONS

3. TECHNOLOGICAL INSTRUCTIONS

3.1. Level Measurements on High-Loss Test Objects

When making level measurements on high-loss four-poles, the transfer impedance between generator and receiver of the measuring set introduces certain problems. Measuring instruments with built-in batteries, as is the case with the Level Measuring Set PS-6/SPM-6, have a noticeable advantage in this respect.

If the ground connections from the generator to the test object and from there to the receiver were ideal (i.e. non-resistive), or the transfer impedance between generator and receiver infinitely great, the measuring accuracy at any high-attenuation values would be only in the order of the accuracy of generator and receiver or dependent on the sensitivity of the latter.



This problem is illustrated in Fig. 3-1. A four-pole, with infinite attenuation represents the object under test. Z_{tr} is the transfer impedance, r_1 and r_2 are the unavoidable ground lead resistance [1] which may be complex, as is also the case with Z_{tr}. A voltage between the generator and receiver cabinets is caused by

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[1] The resistance of coaxial cables and plugs etc., mentioned here as r_1 and r_2, are defined in the following manner:

$$\text{Resistance} = \frac{\text{Voltage drop on the outside of the outer conductor}}{\text{Current on the inside of the outer conductor}}$$

or

$$\text{Resistance} = \frac{\text{Voltage drop on the inside of the outer conductor}}{\text{Current on the outside of the outer conductor}}$$

the voltage drop produced by the generator current across r_1. If the transfer impedance Z_{tr} is finite, a signal current will flow via r_2 which will cause a signal voltage at the receiver input thus simulating a finite attenuation of the test object.
If it is assumed that r_1 and r_2 are small in comparison to Z_{out}, Z_{in}, Z and Z_{tr}, a simple calculation is given by:

$$\frac{U_2}{U_o} = \frac{r_1}{Z_{out}+Z} \times \frac{r_2}{Z_{tr}} \times \frac{Z_{out}}{Z_{out}+Z}$$

If $Z_{out} = Z_{in} = Z$, the effective attenuation $a = 20\ dB \times \log_{10} \left| \frac{U_o}{2\ U_2} \right|$ is obtained as

$$a = 20\ dB \times \log_{10} \left| \frac{2 \times z \times Z_{tr}}{r_1 \times r_2} \right|$$

This attenuation must therefore be approximately 60 dB greater than the attenuation to be measured in order to obtain a maximum error of 0.01 dB (approx. 40 dB for 0.1 dB). This is true if the most unfavourable phase angle between the measuring voltage and the error voltage is assumed.
The transfer impedance Z_{tr} consists of several components; these are the capacitance between the two instruments, the capacitance to ground of both units as well as the impedances caused by the remote-control and power supply cables.

The coaxial input sockets for the remote control connection (Bu 801 and Bu 1901) are isolated from the cabinet of the PS-6; the outer conductor of Bu 801, however, is connected via a resistor of 100 Ω to the chassis, which means that the value of $|Z_{tr}|$ amounts to at least 100 Ω during remote-control operation. This DC value is maintained also during AC line operation because the cabinets (chassis) of both instruments have been carefully isolated from the protective ground connection which is only connected to the protective sceening of the power transformer.

As a result of these measures, the value of Z_{tr} does not fall below 40 Ω during remote control operation. If resistance values of 10 mΩ are assumed for r_1 and r_2 - which is the value obtained with a good double-screened coaxial cable of 50 cm in length - an attenuation of 156 dB can be calculated at Z = 75 Ω for the arrangement shown in Fig. 3-1.

If the Measuring Set PS-6/SPM-6 is operated in its highest attenuation position of 93 dB (Generator level + 1 dB, receive level - 92 dB), the value of 156 dB, calculated assuming the previously measured practical resistance values, leads to an additional error of maximum 0.01 dB.

If high-quality cables are not available - single screened cables offer resistance values of 50 to 200 Ω per metre - or if longer cables cannot be avoided, this battery-operated measuring set allows the transfer impedance between generator and receiver to be improved by increasing the distance between the two instruments and by dispensing with the remote-control of the generator frequency. The transfer impedance is then only given by the capacity - 30 pF at a spacing of 30 cm - between the two instruments. This capacitance will cause, however, a series resonance with the unavoidable inductance of the loop formed by the measuring cables, but the resonant frequency is in excess of 20 MHz with a cable length of approx. 1 m so that the expected impedance of 260 Ω at 20 MHz (corresponding to 30 pF) is only reduced to 130 Ω. It is thus possible to replace Z_{tr} over the whole frequency range with the impedance of a capacitance of less than 60 pF.

It should be mentioned that the advantages of battery operation are also present if only one of the measuring instruments PS-6 or SPM-6 available. Even when the Generator PS-6 or Receiver SPM-6 is operated in conjunction with any grounded measuring instrument, the transfer impedance will be reduced to the impedance value of a capacitance with less than 100 pF.

4. DESIGN DETAILS AND CHARACTERISTICS

4. DESIGN DETAILS AND CHARACTERISTICS

The Level Generator PS-6 operates according to the frequency synthesis principle. The stabilization of the output voltage is made by means of a control circuit. In order to obtain a high level accuracy, a combination of mean-value and peak-value rectification is used which offers the advantages of both systems.

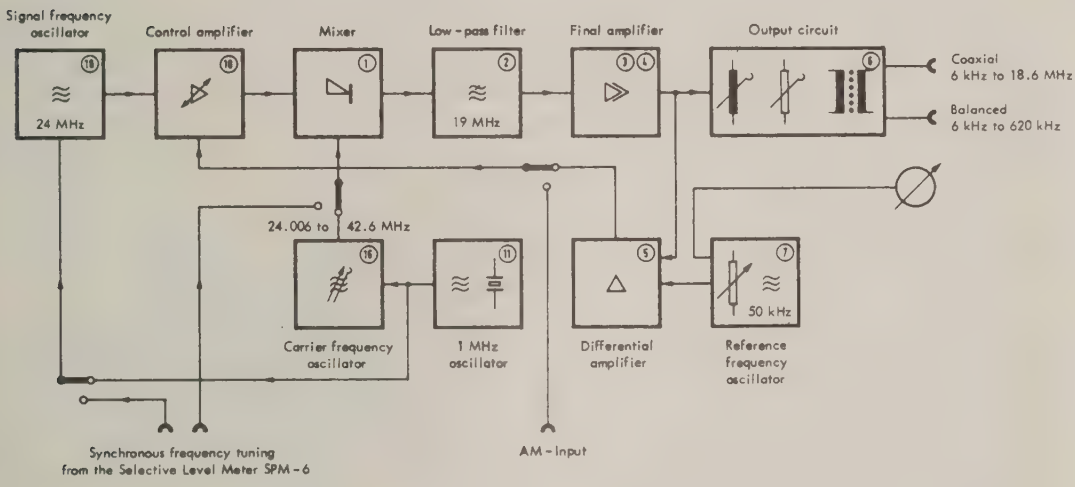

Fig. 4-1 Simplified block diagram

An external amplitude modulation or external level control is possible using the modulation input. The generator frequency may also be synchronously tuned from the Selective Level Meter SPM-6.

4.1. Rectifier Circuit, Level Control

High stability, low temperature coefficient, high linearity and low frequency dependence are the demands made on the rectifier circuit of a level generator. A mean-value rectifier fulfils these requirements with the exception of the low frequency dependence in the required frequency range. A peak-value rectifier on the other hand possesses a good frequency response far in advance of the range in question; however, the linearity and temperature coefficient are poor. The advantages of both rectifier types are combined in the PS-6 (see Fig. 4-2).

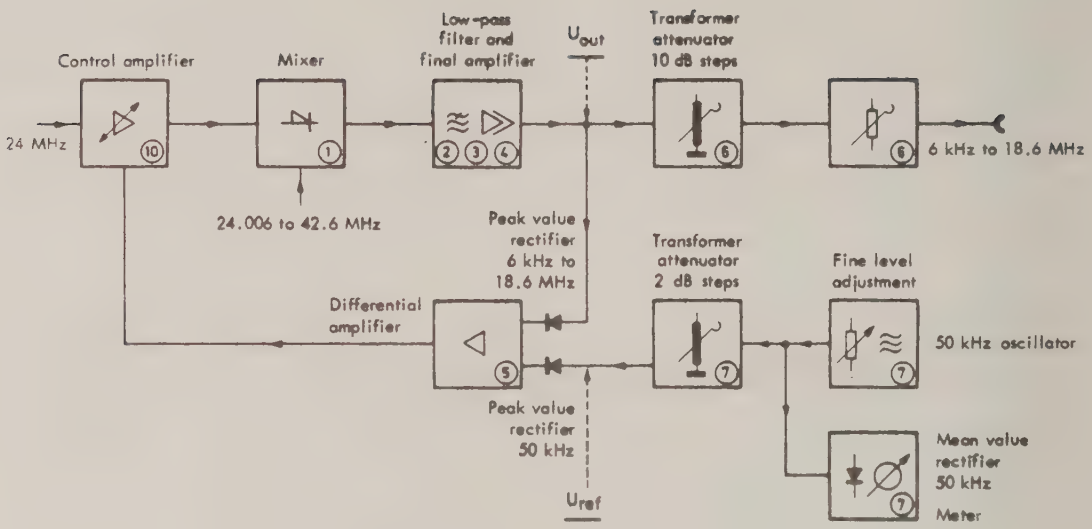

Fig. 4-2

The amplitude control loop via the DC differential amplifier (5) and the 24 MHz control amplifier (10) ensures that the rectified voltage of both peak-value rectifiers are identical. If the characteristics of the diodes coincide, the relationship $U_{out} = U_{ref}$ will also be valid even when the drive characteristics are greatly curved. Since the frequency response of peak-value rectifiers is very good, it is possible for U_{ref} to operate at a fixed frequency of 50 KHz. It is now only necessary to measure the 50 kHz reference voltage U_{ref} instead of the output voltage U_{out}. The reference voltage is rectified in a mean-value rectifier circuit (7) and indicated on a front panel meter. Since the characteristics of the two peak-value rectifiers coincide very accurately, the voltage level/power level switching (not shown in Fig. 4-2) can be placed into the 50 kHz reference circuit (7) in addition to the continuous level adjustment and the 2 dB attenuator steps.

Since the output voltage U_{out} is not directly measured, the level indication is only correct if the control circuit is not overloaded. If overloading occurs, for instance caused by an incorrectly operating stage in the generator, the meter will be switched out of circuit so that an incorrect level reading is avoided.

4.2. Frequency Generation

The 24 MHz oscillator (18) is locked to the frequency of the 1 MHz crystal oscillator (11) .

Generation of the carrier frequency

The carrier frequency f_C for the control of the generator mixer must be tunable in the range of 24 to 4,26 MHz. f_C is derived as the sum of the continuously variable interpolation oscillator frequency f_L 12 (Fig. 4-3) and the frequency f_I of the crystal-controlled phase-locked oscillator (14) , which can be switched in 1 MHz steps.

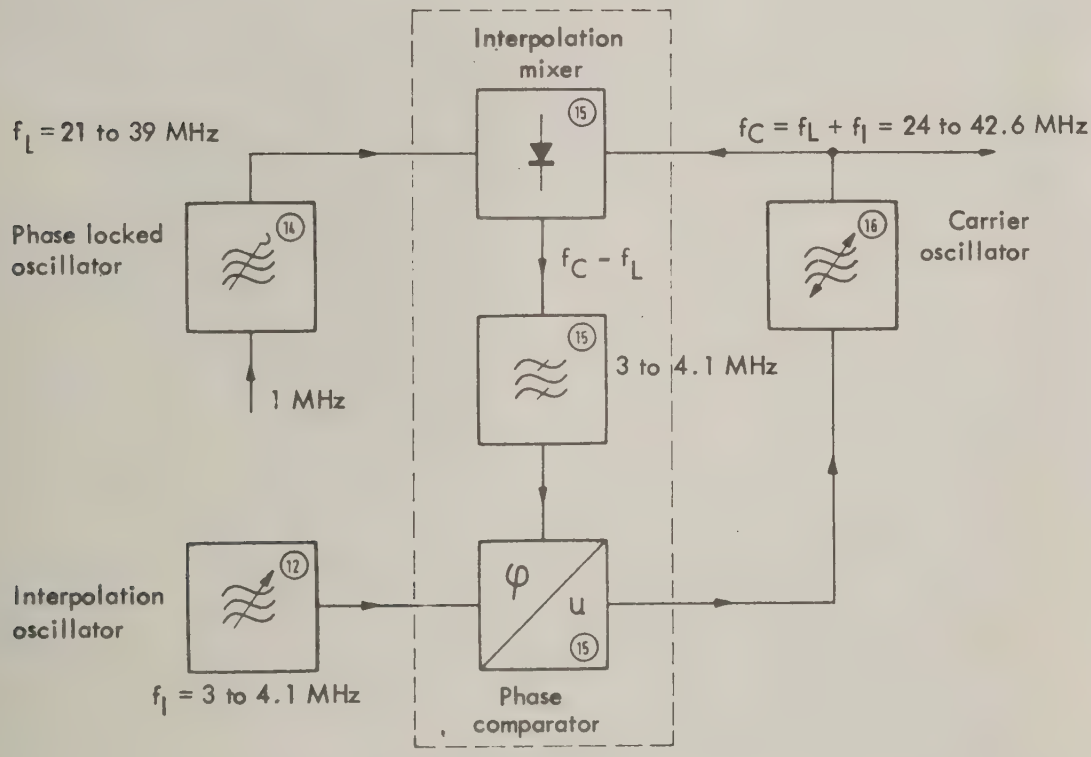

Fig. 4-3 Carrier frequency generation

The interpolation mixer (15) produces a difference frequency $f_C - f_L$. A phase comparator circuit compares it with the frequency f_I of the interpolation ascillator. The output voltage of this phase comparator controls the frequency f_C of the carrier oscillator in such a manner that $f_C = f_L + f_I$. By means of a tuning indicator the frequency of the interpolation oscillator f_I can be checked and if necessary reset in multiples of 10 kHz by comparison against a 10 kHz spectrum which has also

been derived from the 1 MHz crystal oscillator.

The tuning frequency selected is displayed on a five position digital display. The first two digits are mechanically coupled with the phase-locked oscillator selector (frequency range switch); the last three digits are set with the aid of the interpolation oscillator tuning (fine tuning of the frequency).

In addition the frequency range switch has three positions which (on request) allows three fixed frequencies to be selected. Any frequencies within the frequency range of 6 kHz to 18.6 MHz can be chosen. In these switch positions, the interpolation oscillator is replaced by quartz crystal oscillators.

In a further position of the frequency range switch, marked "SPM-6", the generator frequency of the PS-6 will be synchronously tuned from the Selective Level Meter SPM-6 providing that the necessary auxiliary connections have been made on the rear panels of both instruments.

5. MAINTENANCE AND GENERAL INFORMATION

5. MAINTENANCE AND GENERAL INFORMATION

Caution: The AC line plug should be disconnected from the AC line before opening the instrument.

5.1. Mechanical Build - up

The cabinet dimensions correspond to the American standards RETMA and ASEC 839 as well as to the new German Industrial Standard DIN 41 494. It is thus suitable for installation in a 19" rack. The cover, lower, rear and side panels are manufactured from aluminum which has been plastic covered on the outer surface.

These panels are removed by releasing the corresponding screws on the rear panel and drawing the panel to the rear. The switches and circuitry are then easily reached. The upper portion is constructed in the form of a hinged chassis to allow access to the sub-units located in the centre of the instrument. This hinged chassis can be swung-out after releasing two screws and the drive coupling. It may be necessary to completely remove the hinged chassis to exchange components. This is achieved by removing one "subminax" plugs, a multipole Amphenol plug and the right-hand hinge.

5.2. Switch Maintenance

The only maintenance required to avoid mechanical deterioration of the multi-position switches is for the notches to greased at regular intervals.

5.3. Fuse Replacement

The AC line fuse Si 2701 is accessible after opening the hinged chassis (see Fig. 5-1). The 0.8 A slow-blow fuse is required for all AC line voltages.

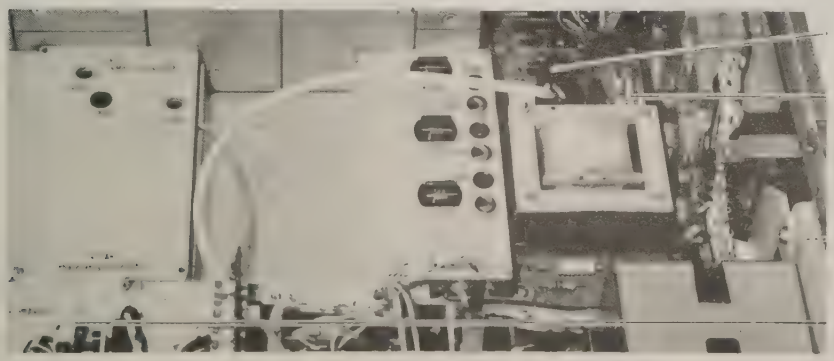

Fig. 5-1

The fuse Si 2501 in the voltage stabilizer is accessible after removing the right-hand side panel.

5.4. Exchanging the Batteries

The internal batteries are maintenance-free; they are made up of 6 nickel-cadmium cell units placed in series and have a charge capacity of 500 mA/h. Each battery consists of 5 cells which are held together with shrunk plastic tubing.

If it is desired to remove the batteries, for instance, during continuous AC line operation, it will be necessary to remove the right-hand side panel (after releasing two screws on the rear panel). The batteries can now be removed with the aid of the straps provided for this purpose.

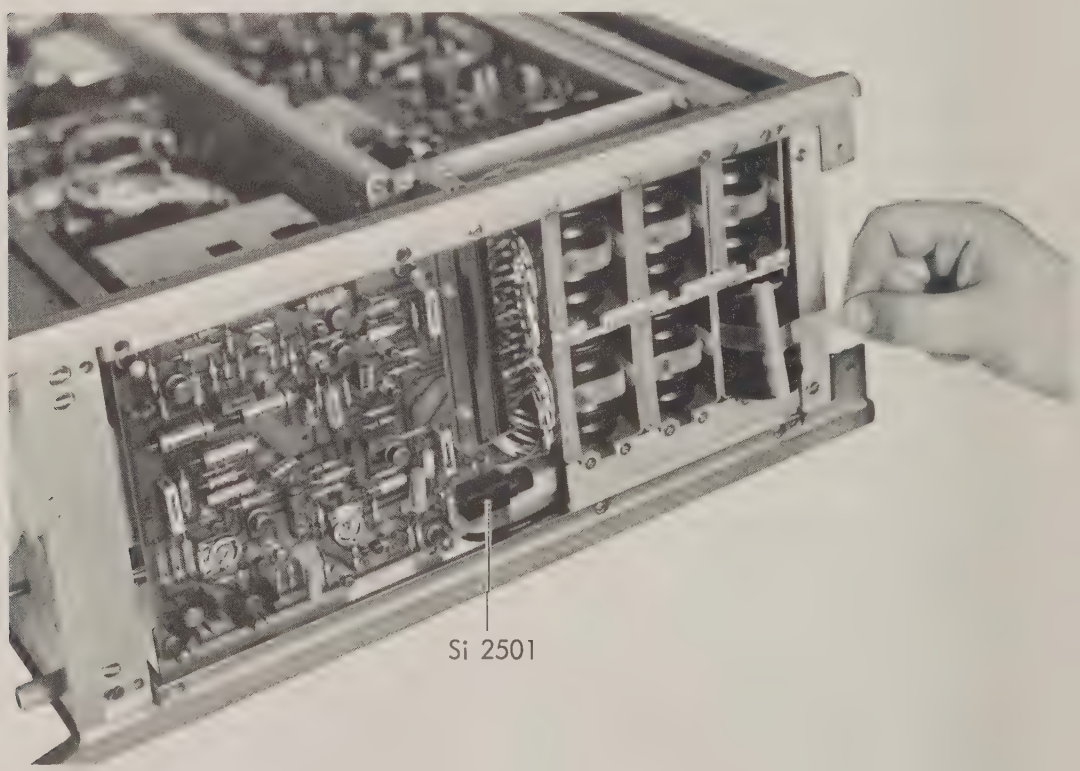

Fig. 5-2

5.5. Universal Socket

The coaxial outputs and the control output of the PS-6 are equipped with the new 75Ω universal socket manufactured by Wandel u. Gottermann. This has the advantage of allowing the mentioned connection sockets on the measuring instrument to

be rapidly modified without the need of soldering. The required socket conversion piece is screwed into the universal socket with the aid of the mounting spanner (Order No. W 1). The following conversion pieces are available:

Universal socket	Lemo	BNC	1,6/5,6	2;5/6	1,6/10	Western Electric 558 A

Fig. 5-3

5.6. Mounting the Instrument in a 19" Rack

When the instrument is to be mounted in a 19" rack, the total front panel width can be increased to fit the rack by exchanging the side pieces of the cabinet frame.

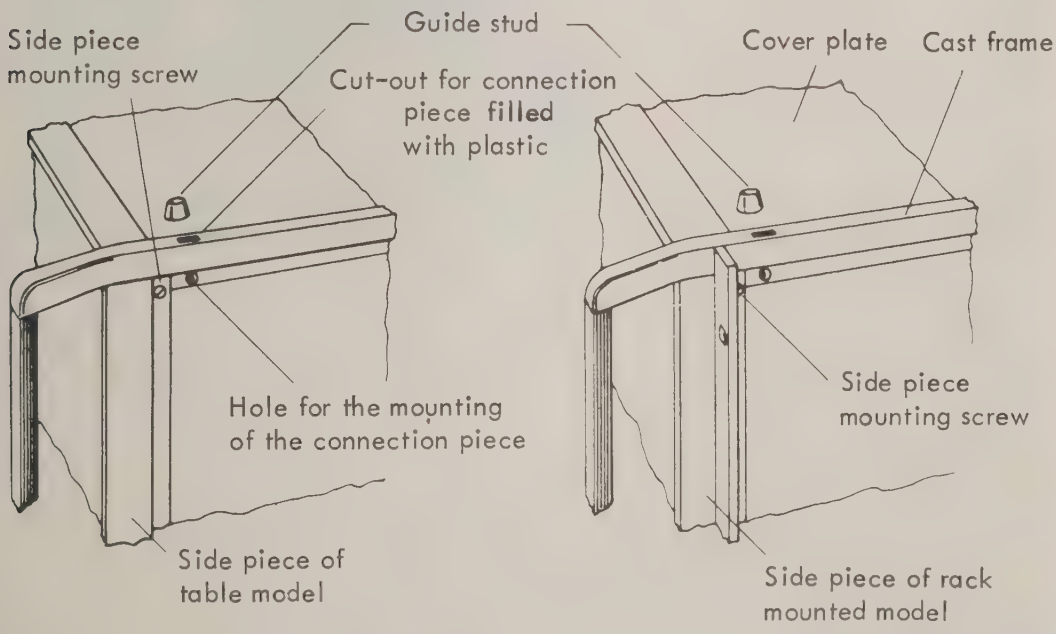
Side piece mounting screw
Guide stud
Cut-out for connection piece filled with plastic
Hole for the mounting of the connection piece
Side piece of table model
Cover plate
Cast frame
Side piece mounting screw
Side piece of rack mounted model

Fig. 5-4 Exchanging the side pieces of table or rack mounted models.

To do this, it is necessary to remove the side panels of the instrument. The " side pieces for the table model" are now replaced by the 19" mounting brackets available under order number 00-0404.07/4.
The foot pieces and guide studs can be detached after removing the cover and lower panel. The side panels, the cover and the lower panel should be now remounted.

5.7. Joining of Several Instruments

The new cabinet conception allows the mounting of several instruments one above the other. These instruments are firmly mounted together by means of special connection pieces with the order number 00.0400.06/5.
To do this, it is necessary to remove the top panel of the lower instrument and the lower panel of the upper instrument as well as the side panels of both. The small plastic pieces in the frame cut-outs are now pushed out. This is valid both for the four cut-outs of the upper frame and the four cut-outs of the lower frame.

The 4 connection pieces are placed into the cut-outs of the lower instrument as shown in Fig. 5-5 and are screwed firmly into place. After removing the guide stud from the cover and the foot pieces from the lower panel, both panels should be replaced.

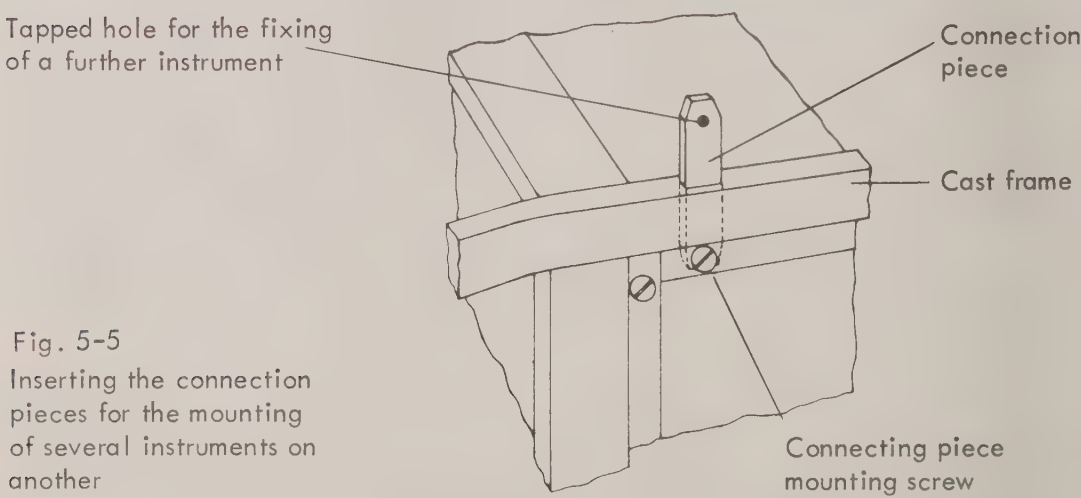

Fig. 5-5
Inserting the connection pieces for the mounting of several instruments on another

The instruments are now placed one above the other so that the connection pieces mounted in the frame of the lower instrument pass through the frame cut-outs of the upper instrument. After firmly screwing the upper instrument to the connection pieces, the side panels should be replaced.

5.8. Installation and Removal of the Fixed Frequency Oscillators (Pilots)

The PS-6 is prepared for the later addition of fixed frequencies. If the generator is switched to one of the fixed frequencies, the phase-locked oscillator remains in operation and only the interpolation oscillator is replaced by a crystal oscillator; the latter must oscillate, corresponding to the required frequency, in the range of 3 to 4 MHz. The generator frequency results as the sum of the phase-locked and the fixed frequency minus 24 MHz.

Socket Bu 2406 for the connection of a frequency counter

Fixed frequency oscillator 341-AC

Circuit board 341-Z or 341 BU

Fig. 5-6

The following procedure must be carried out for the subsequent installation or modification:

1. Insert crystal
2. Prepare frequency range switch
3. Tune oscillator

To 1: The fixed-frequency oscillators (13) are accessible after removing the instrument cover and opening the hinged chassis. The fixed-frequency oscillators

I, II or III can be equipped with the required crystal in the range of 3 to 4 MHz.[1)]

To 2: Two wired bridges are to be soldered on to PC-board 341-Z or 341-BU, so that phase-locked oscillator (14) and the fixed frequency oscillator supply a frequency 24 MHz higher than the generator frequency.

Examples:

Required fixed frequency:	a) Pilot I = 1.364 MHz	b) Pilot II = 11.096 MHz
Pilot crystal frequency f_Q = 3 MHz + decimal numbers of the pilot frequency in MHz	= 3.364 MHz	= 3.096 MHz
Phase-locked oscillator frequency $f_{PL} = f_{gen} + 24\ MHz - f_Q$	= 22.0 MHz	= 32.0 MHz

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f_{PL} = phase-locked oscillator frequency, f_{gen} = generator fixed frequency

f_Q = crystal frequency of the pilot.

---

	on circuit board 341-Z	on circuit board 341-BU
The following bridges should be made:	a) c - i and z - ad	v - d and u - b
	b) e - h and x - ah	x - p and w - L

The following tables list the frequencies and the corresponding bridges to be soldered.

Table 5-1: For instruments up to 17 MHz (Series A BN 340 and 340/1)

Table 5-2: For instruments up to 18.6 MHz (Series A BN 340/2, Series B: all instruments).

To 3: After having connected the bridges according to Table 1 and 2, it is only necessary to align the fixed-frequency oscillators, with the aid of a frequency counter (see 5.8.1.)

1)
Series A: BN 340 and BN 340/1: PC-board 341-Z
Series A: BN 340/2 and all instruments after Series B: PC-board 341-BU

Table 5-1

Pilot frequencies	Phase-locked frequencies	Pilot I	Pilot II	Pilot III
0 to 1 MHz	21 MHz	c - i and z - l	e - i and x - l	f - i and w - l
1 to 2 MHz	22 MHz	c - i and z - ad	e - i and x - ad	f - i and w - ad
2 to 3 MHz	23 MHz	c - i and z - ac	e - i and x - ac	f - i and w - ac
3 to 4 MHz	24 MHz	c - g and z - l	e - g and x - l	f - g and w - l
4 to 5 MHz	25 MHz	c - g and z - r	e - g and x - r	f - g and w - r
5 to 6 MHz	26 MHz	c - g and z - s	e - g and x - s	f - g and w - s
6 to 7 MHz	27 MHz	c - g and z - ab	e - g and x - ab	f - g and w - ab
7 to 8 MHz	28 MHz	c - h and z - l	e - h and x - l	f - h and w - l
8 to 9 MHz	29 MHz	c - h and z - ae	e - h and x - ae	f - h and w - ae
9 to 10 MHz	30 MHz	c - h and z - af	e - h and x - af	f - h and w - af
10 to 11 MHz	31 MHz	c - h and z - ag	e - h and x - ag	f - h and w - ag
11 to 12 MHz	32 MHz	c - h and z - ah	e - h and x - ah	f - h and w - ah
12 to 13 MHz	33 MHz	c - k and z - l	e - k and x - l	f - h and w - l
13 to 14 MHz	34 MHz	c - k and z - m	e - k and x - m	f - k and w - m
14 to 15 MHz	35 MHz	c - k and z - n	e - k and x - n	f - k and w - n
15 to 16 MHz	36 MHz	c - k and z - o	e - k and x - o	f - k and w - o
16 to 17 MHz	37 MHz	c - k and z - p	e - k and x - p	f - k and w - p

Table 5-2

Pilot frequencies	Phase-locked frequencies	Pilot I	Pilot II	Pilot III
0 to 1 MHz	21 MHz	v - d and u - c	x - d and w - c	z - d and y - c
1 to 2 MHz	22 MHz	v - d and u - b	x - d and w - b	z - d and y - b
2 to 3 MHz	23 MHz	v - d and u - a	x - d and w - a	z - d and y - a
3 to 4 MHz	24 MHz	v - d and u - ab	x - d and w - ab	z - d and y - ab
4 to 5 MHz	25 MHz	v - i and u - h	x - i and w - h	z - i and y - h
5 to 6 MHz	26 MHz	v - i and u - g	x - i and w - g	z - i and y - g
6 to 7 MHz	27 MHz	v - i and u - f	x - i and w - f	z - i and y - f
7 to 8 MHz	28 MHz	v - i and u - e	x - i and w - e	z - i and y - e
8 to 9 MHz	29 MHz	v - i and u - ab	x - i and w - ab	z - i and y - ab
9 to 10 MHz	30 MHz	v - p and u - n	x - p and w - n	z - p and y - n
10 to 11 MHz	31 MHz	v - p and u - m	x - p and w - m	z - p and y - m
11 to 12 MHz	32 MHz	v - p and u - l	x - p and w - l	z - p and y - l
12 to 13 MHz	33 MHz	v - p and u - k	x - p and w - k	z - p and y - k
13 to 14 MHz	34 MHz	v - p and u - ab	x - p and w - ab	z - p and y - ab
14 to 15 MHz	35 MHz	v - t and u - s	x - t and w - s	z - t and y - s
15 to 16 MHz	36 MHz	v - t and u - q	x - t and w - q	z - t and y - q
16 to 17 MHz	37 MHz	v - t and u - r	x - t and w - r	z - t and y - r
17 to 18 MHz	38 MHz	v - t and u - o	x - t and w - o	z - t and y - o
18 to 18,6MHz	39 MHz	v - t and u - ab	x - t and w - ab	z - t and y - ab

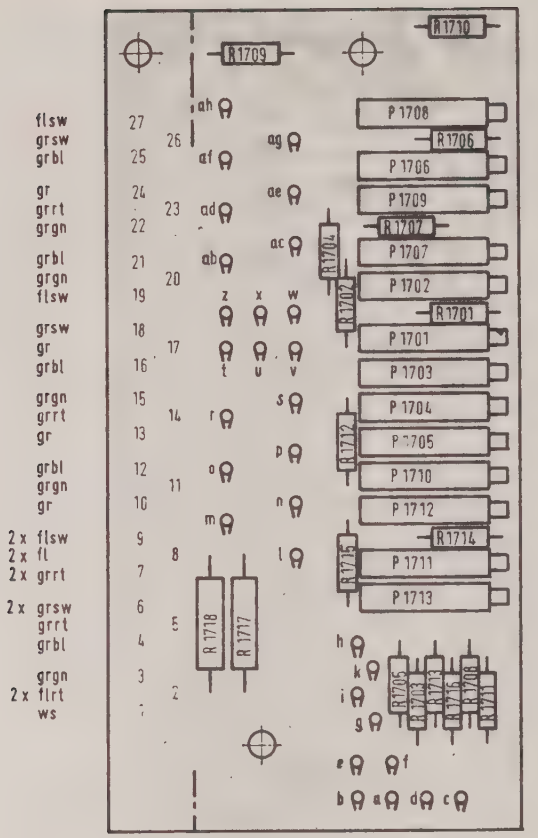

Bild (Fig.) 5-7
341-Z

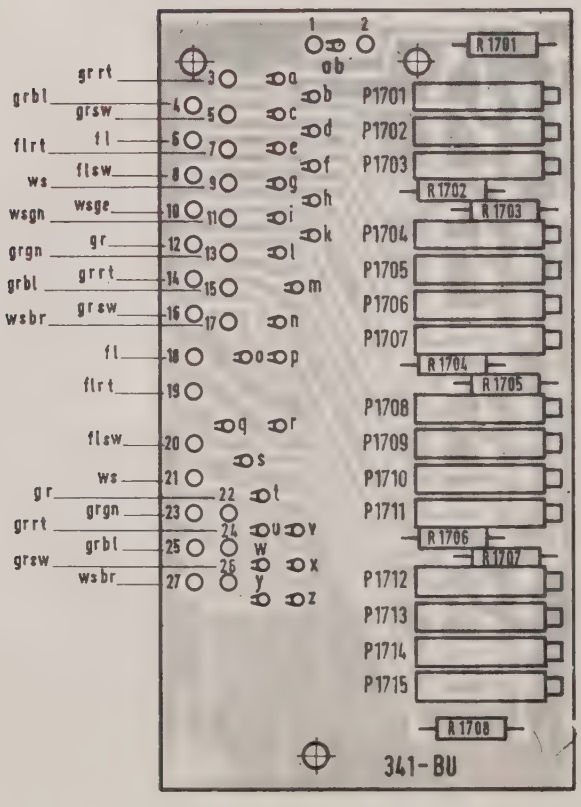

Bild (Fig.) 5-8
341-BU

5.8.1. Alignment to the Nominal Frequency

Required measuring equipment: Frequency counter covering up to 20 MHz
(e.g. FZ-2 from Wandel u. Goltermann)

The frequency of the 1 MHz oscillator must be measured and if necessary aligned before commencing the alignment procedure. The frequency measurement is made at test point TP 1102 using an accurate frequency counter. The frequency has been aligned in the factory to 1 MHz ± 1Hz. Any required correction can be carried out using C 1102.

The fixed frequency can be measured by connecting a frequency counter directly to one of the generator outputs.

Oscillator I is now aligned with trimmers C 1303 and C 1305, at the same time observing the frequency counter, until the digital read-out coincides with the required frequency f_Q. The alignment has the same accuracy as that of the frequency counter used. This must be better than 5×10^{-6}.

The corresponding trimmers for oscillator II are C 1309 and C 1311 or C 1315 and C 1317 for oscillator III. If the capacitance range of the trimmers is not sufficient, a ceramic capacitor (with a max, of 40 pF) can be placed in parallel at the clamps a - b, c - d or e - f.

5.9. Instructions for Mobile Operation

The instrument possesses a precision pointer support, which must be protected during transport. The mode switch should therefore be in the position "off" where the meter will be damped and thus protected against shock.

5.10. Storage

If the level generator is to be stored for a long period, it is advisable to previously remove the batteries (see 5.4.) and to recharge them at certain intervals.

5.11. Transport Instructions

A safe transport of the measuring instrument can only be guaranteed if an adequate packing is used. If the original packing has been discarded, the instrument should only be packed as shown in the following drawing. Fig.5-9.

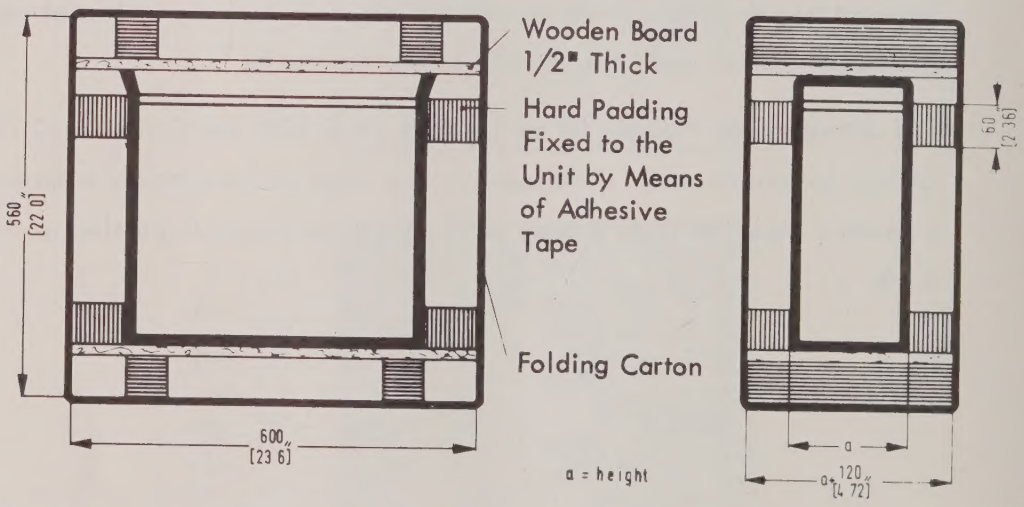

Fig. 5-9

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High Precision Electronic Measuring Instruments